# CHAPTER X

# POLICY APPLICATION: KALAMAZOO RIVER CONTAMINATION

## Biological Scenarios

The Kalamazoo river, located in the southwestern portion of the lower Peninsula of Michigan, flows in a westerly direction and discharges into Lake Michigan. High levels of PCBs contaminate approximately 80 miles of the river upstream from Lake Michigan, affecting the biota (particularly fish),water and sediment. The site, listed on the Superfund National Priorities List, is identified as the third worst contamination site in Michigan. Evidence suggests that contaminated sediments in natural depositional areas and behind both drawn-down and operating hydroelectric dams[2] are continuing sources of PCBs to the water column and to fish. A fish consumption advisory is in place for the stretch of the river with upstream mobility. The International Joint Commission has identified the Kalamazoo rive: as one of 14 *Areas of Concern* in Michigan.

The Michigan Department of Natural Resources has proposed a multi-action management plan for the Kalamazoo River. This plan includes passing anadromous fish

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[1] The description of AOC below is based on the 1989 Report on Great Lakes Water Quality, Appendix A, by the Great Lakes Quality Board of the International Joint Commission.

[2] An estimated 104,000 kg of PCBs reside in the sediments.

over several dams, rehabilitating the resident fish community in a large reach of the river, and reducing problems of chemical contamination (mostly PCB's) in the River. Because the fishery management actions will take place if and only if the PCB cleanup occurs, the benefits of the plan should be evaluated as a single policy option.

Baseline:

The baseline for the policy scenario is the current situation, defined by the base data with which the discrete choice model is estimated.

Scenario: PCB Cleanup

The scenario is designed to capture the expected results from implementation of the Kalamazoo River Remedial Action plan.

Contamination:

Cleanup of the PCB contaminated sediments in the river will eliminate the designated Areas Of Concern in Allegan (3) and Kalamazoo (39) counties.[3] In addition, fish contamination advisories can be eliminated on warmwater river fisheries in both of these counties. Fish contamination advisories are expected to remain in effect on Great Lakes and anadromous fisheries in these counties since the contaminants in these fish are accumulated during life in Lake Michigan. Containment of contaminants in the Kalamazoo River will reduce discharge of these contaminants into Lake Michigan but the reduction will be only a marginal change in total loading on Lake Michigan.

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[3] This will potentially affect all product lines.

| Product Line | County | Variable | [Baseline] | [Policy] |
|---|---|---|---|---|
| All | Allegan | AOC | 1 | 0 |
| | Kalamazoo | AOC | 1 | 0 |
| ISww | Allegan | CntmSW | 55 | 0 |
| | Kalamazoo | CntmSW | 15 | 0 |
| ILww | Allegan | CntmLW | 1200 | 0 |

Anadromous Product Line: Catch Rates

Containment of contaminated sediments will permit removal of three state-owned dams from the Kalamazoo River. Construction of fish ladders on remaining dams would open 44 miles of river to anadromous trout and salmon fishing, with 18 miles in Allegan county and 26 miles in Kalamazoo county. Reservoirs in both counties would support inland lake fishing for anadromous trout and salmon. Catch of anadromous trout and salmon rates in Allegan county should increase modestly, perhaps 20% for each species. Catch rates of anadromous fish in Kalamazoo county (currently non-existent) should compare to these increased catch rates in Allegan county as follows:

| Product Line | County | Species | Month | CR = Allegan CR x |
|---|---|---|---|---|
| Anad | Kalamazoo | Chinook | September | 0.25 |
| | | Chinook | October | 0.90 |
| | | Coho | September | 1.00 |
| | | Coho | October | 1.00 |
| | | Rainbow | April | 2.00 |
| | | Rainbow | May | 1.50 |
| | | Rainbow | September | 1.50 |
| | | Rainbow | October | 2.00 |

Other Product Lines: Quantity of Fishing Resources

Rehabilitation of the warmwater fish community in the Kalamazoo River, combined with PCB containment and dam removal should convert 34 miles of second

quality, mainstream, warmwater river to top quality, mainstream, warmwater river. Of these 34 miles, 18 miles are in Allegan county and 16 miles are in Kalamazoo county. In addition, 10 miles of a second quality, warmwater tributary in Allegan county would be converted to a second quality trout tributary.

The product lines and variable affected are shown below:

| Product Line | County | Variable | Change in value |
|---|---|---|---|
| ISww | Allegan | ISww1main | +18 |
| ISww | Allegan | ISww2main | –18 |
| ISww | Kalamazoo | ISww1main | +16 |
| ISww | Kalamazoo | ISww2main | –16 |
| ISww | Allegan | ISww2trib | –10 |
| IScd | Allegan | IScd2trib | +10 |

The two Michigan counties affected by the Kalamazoo river cleanup plan are shown in map X.1.

**Consumer Surplus Calculation**

In this section, we carry out similar calculations as we do for the Ludington case to estimate people's willingness-to-pay for the cleanup plan of the Kalamazoo river contamination. The compensating variation for the open-water fishing season according to formula V.28 in chapter V is still computed as

$$W = \sum_i \sum_m \sum_d \left[ \frac{T^1_{imd} \cdot \bar{I}^1_{imd} - T^0_{imd} \cdot \bar{I}^0_{imd}}{\tilde{\eta}_d / 100} \right]$$

where

**i** indexes individuals in the sample of our consumer surplus analysis.

**m** indexes months (April — October) in an open-water season,

**d** indexes trip durations (= Day, Wkn, Vac).

**0** refers to the "before cleanup" case.

**1** refers to the "after cleanup" case.

$\tilde{\eta}_d$ is the weighted MUI per \$100, for trip duration type $d$.

**T** is the number of total trips in the season.

$\bar{I}$ is the pseudo-IV defined in chapter III.

Table X.1 presents the conditional compensating variation per trip $(\bar{I}^1_{id} - \bar{I}^0_{id}) \times 100/\tilde{\eta}_d$ in 1984 dollars (averaged over the seven open-water fishing months) associated with the Kalamazoo river cleanup. The expected increase in value per trip is larger than that of the Ludington case. Table X.2 reports the predicted number of season trips $T^0$ without the cleanup using the exponential model estimates. Tables X.3 and X.4 report the predicted change in total trips $(T^1_{id} - T^0_{id})$ and the total compensating variation $(W_d)$ in 1984 dollars for one open-water season if the cleanup plan is implemented. Again, we predict that more day and weekend trips and fewer vacation trips will be taken as a result of the cleanup. The total seasonal compensating variation for the sample is calculated to be $W$ = \$2920.63 (in 1984\$) from the subtotals in table X.4.

We then extrapolate the sample CV to the population similarly as

$$\begin{aligned} W^* &= \mathrm{CPI}\left(\frac{91}{84}\right) \times \frac{P}{N} \times \frac{N}{S} \times W \\ &= 1.348 \times \frac{1414914}{10948} \times \frac{10948}{4824} \times 2920.63 \\ &= \$1{,}153{,}699.41 \end{aligned}$$

where $P$ = 1,414,914 is the total population of licensed anglers in 1984. $N$ = 10,948 is the sample size of the MDNR data, and $S$ = 4824 is the number of people in our consumer surplus sample. $N/S$ is the factor for extrapolating from the consumer surplus sample to the MDNR sample. $P/N$ is the factor for extrapolating from the MDNR sample to the total population of licensed anglers.

Therefore, the final extrapolation from the sample to the population of licensed anglers yields an annual consumer surplus of \$1.15 million (in 1991\$) from the implementation of the Kalamazoo river PCB cleanup plan. Because no other studies have

been conducted for site quality changes of this nature in the past, we have no outside estimates against which to compare these numbers.

Map X.1: Michigan counties affected by the Kalamazoo scenario

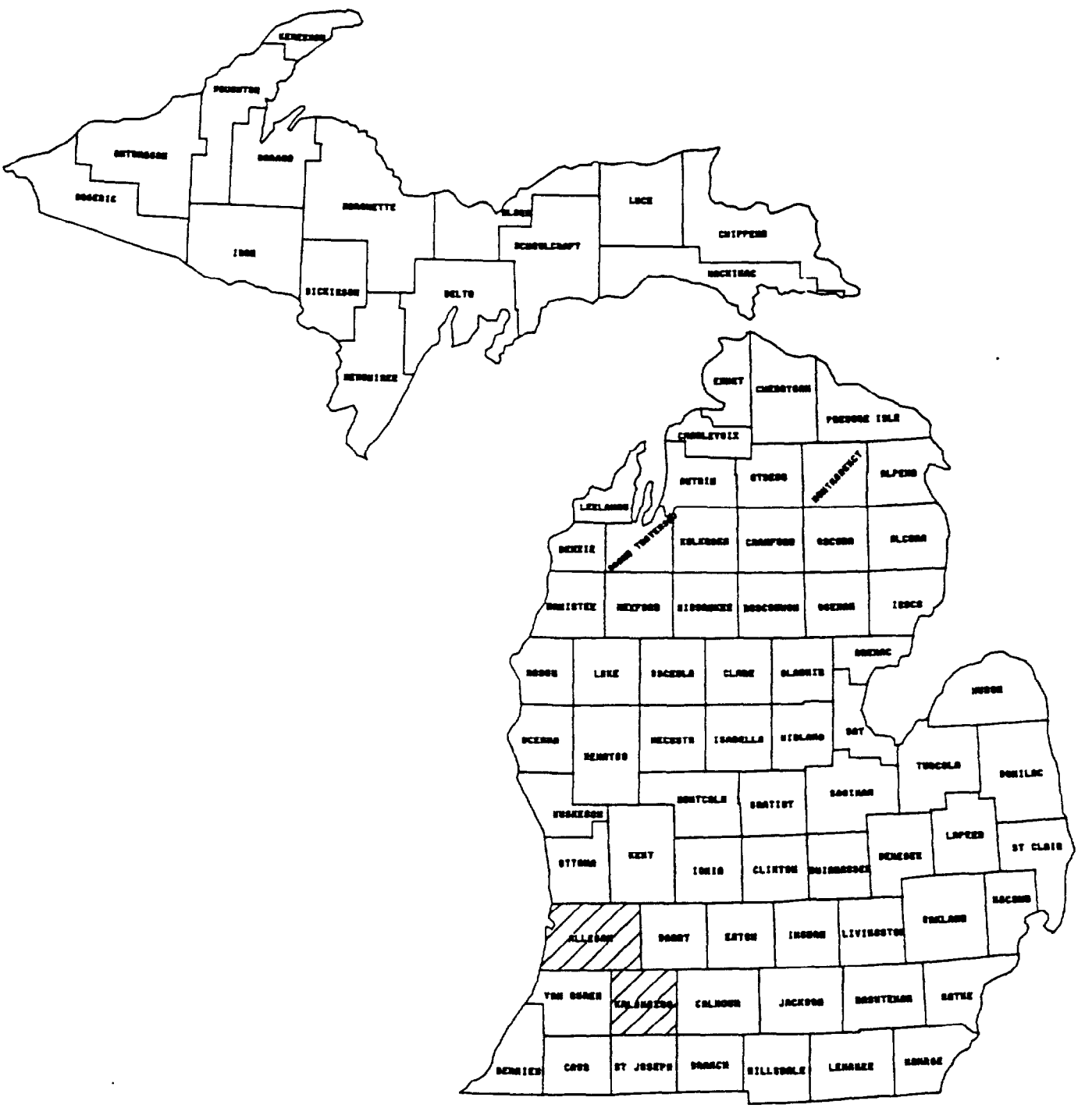

Table X.1: Kalamazoo: Mean compensating variation per trip in 1984 dollars

| | N | Day Trip | Wkn Trip | Vac Trip |
|---|---|---|---|---|
| Day Sample | 2463 | 0.1048 | 0.3093 | 0.1999 |
| Wkn Sample | 1159 | 0.1058 | 0.3245 | 0.2103 |
| Vac Sample | 1202 | 0.1115 | 0.3680 | 0.2270 |

Table X.2: Kalamazoo: Total trips per person before PCB cleanup

| | N | Day Trip | Wkn Trip | Vac Trip |
|---|---|---|---|---|
| Day Sample | 2463 | 1.2513 | 0.5502 | 0.4423 |
| Wkn Sample | 1159 | 1.1506 | 0.5675 | 0.5171 |
| Vac Sample | 1202 | 0.9044 | 0.4960 | 0.6831 |
| **Total** | **4824** | **5502.47** | **2609.01** | **2509.78** |

Table X.3: Kalamazoo: Mean change in season trips

| | N | Day Trip | Wkn Trip | Vac Trip |
|---|---|---|---|---|
| Day Sample | 2463 | 0.0118 | 0.0023 | –0.0029 |
| Wkn Sample | 1159 | 0.0112 | 0.0024 | –0.0037 |
| Vac Sample | 1202 | 0.0100 | 0.0024 | –0.0054 |
| **Total** | **4824** | **54.10** | **11.34** | **–17.94** |

Table X.4: Kalamazoo: Mean season compensating variation in 1984 dollars

| | N | Day Trip | Wkn Trip | Vac Trip |
|---|---|---|---|---|
| Day Sample | 2463 | 0.2924 | 0.2436 | 0.0942 |
| Wkn Sample | 1159 | 0.2310 | 0.2523 | 0.1172 |
| Vac Sample | 1202 | 0.1705 | 0.2272 | 0.1615 |
| **Total** | **4824** | **1192.99** | **1165.58** | **562.06** |

# APPENDIX

## Sensitivity Analysis of Trip Time Costs

We perform a sensitivity analysis to the alternative treatments of travel time discussed above in Chapter III for the Great Lakes coldwater product line. To make the estimates comparable, we have to restrict the sample sizes to be the same across runs. The number of anglers in the samples are the same, though the choice sets for each of the anglers are different under each hypothesis. Therefore, the difference in the estimates will come from the different definitions of the choice set and the different definitions of the travel cost to a site.

We estimate the three models derived in Chapter III. The sample without missing data for the exogenous trip days model is larger than for the other two models, because it does not require use of the variable measuring trip hours, which has numerous missing values. To separate out the effect of the different samples, we estimate that model twice: once for the restricted sample used for the other two models and once for its full sample.

1. The exogenous on-site time model *(SiteTime).*

2. The exogenous trip time model *(TrpTime).*

3. The exogenous trip duration in days, using a sample defined by the above models *(TrpDays-Subset).*

4. The exogenous trip duration in days, using the sample defined by its own time constraints *(TrpDays-Full).*

The estimates for the three trip durations are presented in the tables in this Appendix. The travel time cost variable is only included in the site choice portion of the NMNL model for the SiteTime model. For the other treatments of travel time, the travel time cost becomes part of the total cost of choosing a trip duration, and is included (along with on-site time costs ) in the WageCost variable in the Participation model. Due to the correlation between the distance cost variable and the travel time cost variable, the estimated marginal utility of income, (the parameter of the distance cost variable), is much smaller for the SiteTime version than for the other three models.

The parameter estimates are, in general, quite different across the four models. To compare across the specifications the contribution of each quality attribute to angler value during the choice occasion, we translate the effects into monetary terms by dividing by the MUI. See the bottom of these tables for the calculations. The contributions of most quality attributes increase in monetary terms as the trip length increases. The exogenous SiteTime model predicts higher (in absolute value terms) contributions from the quality attributes than the other models. partly because its MUI is smaller.

Since the exogenous on-site time hypothesis is theoretically flawed and the trip days model may have substantial measurement error, we use the exogenous Trip Time model for our NMNL analysis.

Table A.1 MNL estimates for the GLcd-Day sample

| Variable | SiteTime | TrpTime | TrpDays (Subset) | TrpDays (Full) |
|---|---|---|---|---|
| Dist$/100 | -14.51 | -17.27 | -18.28 | -16.01 |
| | (-12.04) | (-16.42) | (-17.76) | (-19.11) |
| Time$/100 | -2.33 | N.A. | N.A. | N.A. |
| | (-3.77) | | | |
| AOC | -1.58 | -1.53 | -1.55 | -1.53 |
| | (-8.82) | (-8.53) | (-8.61) | (-9.35) |
| %Forest | 2.87 | 2.34 | 2.22 | 1.69 |
| | (4.89) | (4.12) | (3.93) | (3.42) |
| Feature | 0.09 | 0.08 | 0.08 | 0.26 |
| | (0.41) | (0.39) | (0.38) | (1.39) |
| Chinook Salmon | 9.10 | 8.36 | 8.80 | 10.59 |
| | (4.17) | (3.88) | (4.20) | (5.74) |
| Coho Salmon | 4.07 | 3.87 | 4.08 | 3.41 |
| | (1.96) | (1.86) | (2.00) | (1.90) |
| Lake Trout | 3.70 | 3.32 | 3.48 | 4.28 |
| | (1.81) | (1.67) | (1.77) | (2.47) |
| Rainbow Trout | 1.75 | 2.19 | 1.80 | 1.83 |
| | (0.35) | (0.42) | (0.36) | (0.41) |
| Log Likelihood | -509.1 | -518.5 | -528.9 | -657.2 |
| $\chi^2$-test | 943.7 | 727.3 | 1263.8 | 1355.9 |
| %Choices Right | 50.6 | 50.6 | 50.3 | 51.2 |
| #People | 336 | 336 | 336 | 387 |
| #Choices | 7012 | 5565 | 10743 | 12326 |
| $(\partial V/\partial AOC)/MUI$ | -0.11 | -0.09 | -0.09 | -0.10 |
| $(\partial V/\partial Forest)/MUI$ | 0.20 | 0.14 | 0.12 | 0.11 |
| $(\partial V/\partial Feature)/MUI$ | 0.01 | 0.01 | 0.00 | 0.02 |
| $(\partial V/\partial Chinook)/MUI$ | 0.63 | 0.48 | 0.48 | 0.66 |
| $(\partial V/\partial Coho)/MUI$ | 0.28 | 0.22 | 0.22 | 0.21 |
| $(\partial V/\partial LakeT)/MUI$ | 0.26 | 0.19 | 0.19 | 0.27 |
| $(\partial V/\partial RainbowT)/MUI$ | 0.12 | 0.13 | 0.10 | 0.11 |

Note: Numbers in parentheses are *t*- statistics.

Table A.2 MNL estimates for the GLcd-Wkn sample

| Variable | SiteTime | TrpTime | TrpDays (Subset) | TrpDays (Full) |
|---|---|---|---|---|
| Dist$/100 | -2.64 | -4.20 | -4.27 | -4.51 |
| | (-5.33) | (-10.77) | (-10.95) | (-11.88) |
| Time$/100 | -0.75 | N.A. | N.A. | N.A. |
| | (-2.93) | | | |
| AOC | -1.67 | -1.75 | -1.76 | -1.70 |
| | (-7.76) | (-8.07) | (-8.11) | (-8.34) |
| %Forest | 1.80 | 1.23 | 1.19 | 1.24 |
| | (4.34) | (3.14) | (3.04) | (3.30) |
| Feature | 0.51 | 0.51 | 0.51 | 0.57 |
| | (3.10) | (3.15) | (3.18) | (3.71) |
| Chinook Salmon | 9.09 | 8.93 | 8.99 | 10.02 |
| | (5.49) | (5.66) | (5.71) | (6.75) |
| Coho Salmon | 6.33 | 5.37 | 5.24 | 5.99 |
| | (3.60) | (3.34) | (3.27) | (3.98) |
| Lake Trout | 0.33 | -1.27 | -1.58 | -0.86 |
| | (0.12) | (-0.49) | (-0.61) | (-0.35) |
| Rainbow Trout | 2.59 | 2.47 | 2.06 | 4.22 |
| | (0.73) | (0.70) | (0.58) | (1.34) |
| Log Likelihood | -740.9 | -795.7 | -800.8 | -878.6 |
| $\chi^2$-test | 229.1 | 321.3 | 341.5 | 393.4 |
| %Choices Right | 16.4 | 15.3 | 14.5 | 15.5 |
| #People | 262 | 262 | 262 | 290 |
| #Choices | 7638 | 10201 | 10690 | 11828 |
| $(\partial V/\partial AOC)/MUI$ | -0.63 | -0.42 | -0.41 | -0.38 |
| $(\partial V/\partial Forest)/MUI$ | 0.68 | 0.29 | 0.28 | 0.28 |
| $(\partial V/\partial Feature)/MUI$ | 0.19 | 0.12 | 0.12 | 0.13 |
| $(\partial V/\partial Chinook)/MUI$ | 3.44 | 2.13 | 2.11 | 2.22 |
| $(\partial V/\partial Coho)/MUI$ | 2.40 | 1.28 | 1.23 | 1.33 |
| $(\partial V/\partial LakeT)/MUI$ | 0.13 | -0.30 | -0.37 | -0.19 |
| $(\partial V/\partial RainbowT)/MUI$ | 0.98 | 0.59 | 0.48 | 0.94 |

Note: Numbers in parentheses are *t*- statistics.

Table A.3: MNL estimates for the GLcd-Vac sample

| Variable | SiteTime | TrpTime | TrpDays (Subset) | TrpDays (Full) |
|---|---|---|---|---|
| Dist$/100 | -1.61 | -2.41 | -2.41 | -2.41 |
| | (-4.17) | (-8.67) | (-8.67) | (-9.30) |
| Time$/100 | 0.21 | N.A. | N.A. | N.A. |
| | (0.93) | | | |
| AOC | -0.86 | -1.03 | -1.03 | -1.05 |
| | (-3.72) | (-4.48) | (-4.48) | (-4.94) |
| %Forest | 2.33 | 2.22 | 2.22 | 2.05 |
| | (4.79) | (4.73) | (4.73) | (4.78) |
| Feature | 0.63 | 0.62 | 0.62 | 0.73 |
| | (4.79) | (3.79) | (3.79) | (4.89) |
| Chinook Salmon | 8.87 | 9.73 | 9.73 | 9.83 |
| | (5.12) | (5.69) | (5.69) | (6.16) |
| Coho Salmon | 5.39 | 4.50 | 4.50 | 4.52 |
| | (3.19) | (2.77) | (2.77) | (2.98) |
| Lake Trout | 4.84 | 4.00 | 4.00 | 3.68 |
| | (3.84) | (3.50) | (3.50) | (3.37) |
| Rainbow Trout | 2.09 | 2.77 | 2.77 | 2.01 |
| | (0.52) | (0.71) | (0.71) | (0.52) |
| Log Likelihood | -589.7 | -640.8 | -640.8 | -748.1 |
| $\chi^2$-test | 153.7 | 203.0 | 203.0 | 240.8 |
| %Choices Right | 14.5 | 14.0 | 14.0 | 14.5 |
| #People | 200 | 200 | 200 | 234 |
| #Choices | 5935 | 8185 | 8185 | 9574 |
| $(\partial V/\partial AOC)/MUI$ | -0.53 | -0.43 | -0.43 | -0.44 |
| $(\partial V/\partial Forest)/MUI$ | 1.45 | 0.92 | 0.92 | 0.85 |
| $(\partial V/\partial Feature)/MUI$ | 0.39 | 0.26 | 0.267 | 0.30 |
| $(\partial V/\partial Chinook)/MUI$ | 5.51 | 4.04 | 4.04 | 4.08 |
| $(\partial V/\partial Coho)/MUI$ | 3.35 | 1.87 | 1.87 | 1.88 |
| $(\partial V/\partial LakeT)/MUI$ | 3.01 | 1.66 | 1.66 | 1.53 |
| $(\partial V/\partial RainbowT)/MUI$ | 1.30 | 1.15 | 1.15 | 0.83 |

Note: Numbers in parentheses are *t*- statistics.

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# MDNR ANGLER SURVEY QUESTIONNAIRE

1983 and 1984

# MICHIGAN SPORT FISHING SURVEY

Dear Angler:

Each year the Department of Natural Resources (DNR) must gather information on recreational fishing in Michigan. One of the best methods is to obtain information directly from the angler. This information will be used to improve fishing opportunities and document the importance of fishing to the state's economy.

Your name has been selected at random from fishing license records. Would you please take a few minutes to answer all the questions. A prompt return of your questionnaire in the postpaid return envelope will be appreciated.

Questionnaires are being sent to a number of anglers but there can be no substitute for the information you, yourself, provide. Your response is needed even if you did not fish or did not catch anything. Be assured that your reply is confidential and will be used only for better management of Michigan's fish resources.

Thank you for your cooperation.

Sincerely,

John A. Scott
Chief, Fisheries Division

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1 a. Where is your permanent residence? County _____ State _____ Zip Code _____

b. How long have you lived there? _____ years. c. How long have you lived in Michigan? _____ years.

2. Are you married? ☐ Yes (go to question 2a) ☐ No (go to question 2b)

2a. Does your spouse fish? ☐ Yes ☐ No

2b. Do you have any children age 16 or younger? ☐ Yes ☐ No (go to question 3)

2c. Please indicate their ages and whether or not they fish:

| Ages | Male | Female | Do they fish? Yes | Do they fish? No |
|---|---|---|---|---|
| ____ | ☐ | ☐ | ☐ | ☐ |
| ____ | ☐ | ☐ | ☐ | ☐ |
| ____ | ☐ | ☐ | ☐ | ☐ |
| ____ | ☐ | ☐ | ☐ | ☐ |

3. Please indicate when you work:

☐ Full-Time Days ☐ Full-Time Nights ☐ Part-Time Days ☐ Part-Time Nights ☐ Retired ☐ Unemployed ☐ Student

4. How long have you been fishing? _____ years. How long have you fished in Michigan? _____ years.

5. How do you rate yourself as an angler? ☐ Beginner ☐ Somewhat experienced ☐ Experienced ☐ Expert

6. Did you fish in any other state or foreign country last year? ☐ Yes ☐ No

If yes, where? _____, _____, _____

and for what species? (e.g. trout) _____, _____, _____

7. Please check one box indicating with whom you fish most often:

☐ Alone ☐ Spouse ☐ Son(s) ☐ Daughter(s) ☐ Other Relatives ☐ Friends

8 Do you own a boat(s) or canoe(s) used for fishing in Michigan? ☐ No ☐ Yes Please complete table below

| | | Length In Feet | Total Days Used Per Year | Days Per Year For Fishing |
|---|---|---|---|---|
| Boats | #1 | | | |
| | #2 | | | |
| Canoes | #1 | | | |
| | #2 | | | |

9 Over the last two years, we would like to know (1) what species did you fish; (2) where did you fish for these species, (3) modes of fishing, eg shore, pier, and (4) fishing method(s) you used. If you fished in more than one location or used more than one method, check all appropriate boxes (see example) Please answer only for the last two years.

| Did you fish for these species over the last two years? | | | Location of Fishing | | | Mode of Fishing | | | | | Fishing Method | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish | Yes | No | Inland Lakes | Great Lakes | Stream/ River | Shore or Wading | Pier or Dock | Rental or Private Boat | Charter Boat | Ice Fishing | Casting | Spin or Spincasting | Bait Fishing | Trolling | Fly Fishing | Spearing | Dipping | Snagging |
| (EXAMPLE) Bass | ☑ | ☐ | ☑ | ☑ | ☐ | ☑ | ☐ | ☑ | ☐ | ☐ | ☐ | ☐ | ☑ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Yellow Perch | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Panfish | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Bass | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Walleye or Sauger | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Pike or Musky | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Lake Trout | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Steelhead | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Rainbow Trout | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Brown Trout | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Brook Trout | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Chinook Salmon | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Coho Salmon | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Catfish or Bullhead | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Suckers or Carp | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Smelt | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

10 Which one of the above species do you most prefer to catch? _____ (name one only) Which one do you most prefer to eat? _____ (name one only)

11 Please name the one mode (listed above) of fishing you most prefer _____ (name one only)

12 Please name the one method (listed above) of fishing you most prefer _____ (name one only)

CONTINUE ➡

15 In order to improve fishing opportunities, we need to know what factors are important to you in selecting where and when to fish. Please check one box indicating the importance you place on the factors shown in the table below:

| | Crucial | Very Important | Important | Somewhat Important | Not Important |
|---|---|---|---|---|---|
| Angler crowding | ☐ | ☐ | ☐ | ☐ | ☐ |
| Competition with other recreationists, e.g., canoes, sailboats | ☐ | ☐ | ☐ | ☐ | ☐ |
| Places to fish from shore | ☐ | ☐ | ☐ | ☐ | ☐ |
| Boat launching facilities | ☐ | ☐ | ☐ | ☐ | ☐ |
| Marina facilities and services | ☐ | ☐ | ☐ | ☐ | ☐ |
| Availability of parking facilities | ☐ | ☐ | ☐ | ☐ | ☐ |
| Nearness of restaurants | ☐ | ☐ | ☐ | ☐ | ☐ |
| Nearness of bait and tackle shops | ☐ | ☐ | ☐ | ☐ | ☐ |
| Nearness of overnight accommodations, e.g., motels, campgrounds | ☐ | ☐ | ☐ | ☐ | ☐ |
| Natural beauty of the area | ☐ | ☐ | ☐ | ☐ | ☐ |
| Solitude | ☐ | ☐ | ☐ | ☐ | ☐ |
| Water clarity | ☐ | ☐ | ☐ | ☐ | ☐ |
| Presence of contaminants in fish | ☐ | ☐ | ☐ | ☐ | ☐ |
| Catch rate of keepable fish | ☐ | ☐ | ☐ | ☐ | ☐ |
| Catch rate of all fish | ☐ | ☐ | ☐ | ☐ | ☐ |
| Presence of favorite fish (species) | ☐ | ☐ | ☐ | ☐ | ☐ |
| Size of fish | ☐ | ☐ | ☐ | ☐ | ☐ |
| Diversity of fish species which can be caught | ☐ | ☐ | ☐ | ☐ | ☐ |
| Nearness to home (travel distance) | ☐ | ☐ | ☐ | ☐ | ☐ |
| Information about the area, e.g. catch rates, best fishing methods, hot spots | ☐ | ☐ | ☐ | ☐ | ☐ |
| Nearness to second home/ cottage camp | ☐ | ☐ | ☐ | ☐ | ☐ |

16 We would also like to know some of the reasons why you fish. Please indicate the importance of the following reasons. Please check the box indicating the importance you place on each reason.

| | Crucial | Very Important | Important | Somewhat Important | Not Important |
|---|---|---|---|---|---|
| *To catch fish to eat* | ☐ | ☐ | ☐ | ☐ | ☐ |
| For relaxation | ☐ | ☐ | ☐ | ☐ | ☐ |
| For companionship | ☐ | ☐ | ☐ | ☐ | ☐ |
| To enjoy nature | ☐ | ☐ | ☐ | ☐ | ☐ |
| For the challenge and excitement | ☐ | ☐ | ☐ | ☐ | ☐ |
| To be alone | ☐ | ☐ | ☐ | ☐ | ☐ |
| To improve my fishing skill | ☐ | ☐ | ☐ | ☐ | ☐ |
| *To get away* | ☐ | ☐ | ☐ | ☐ | ☐ |
| For exercise | ☐ | ☐ | ☐ | ☐ | ☐ |
| Family togetherness | ☐ | ☐ | ☐ | ☐ | ☐ |
| To catch a trophy fish | ☐ | ☐ | ☐ | ☐ | ☐ |
| For a sense of achievement | ☐ | ☐ | ☐ | ☐ | ☐ |

17. What sources of information do you use in selecting where and when to fish?

| | Often | Occasionally | Never |
|---|---|---|---|
| Comments and opinions of other anglers | ☐ | ☐ | ☐ |
| Information provided by the DNR | ☐ | ☐ | ☐ |
| Newspaper articles | ☐ | ☐ | ☐ |
| Magazine articles | ☐ | ☐ | ☐ |
| Bait and tackle shops | ☐ | ☐ | ☐ |
| Radio or TV | ☐ | ☐ | ☐ |

CONTINUE ➡

Now we would like to ask you some questions about the LAST TIME you went fishing in Michigan, even if fishing wasn t the primary purpose of the trip We are interested in your last trip even if you walked to a fishing site located near or adjacent to your home

18 When did you leave home on this trip?

| | Month | Day | Year | Time |
|---|---|---|---|---|
| (Example) | June | 5 | 1983 | 8 a.m. |

19. When did you arrive back home from this trip?

| | Month | Day | Year | Time |
|---|---|---|---|---|
| (Example) | June | 6 | 1983 | 9:30 p.m. |

20. Where did the majority of fishing on this trip take place? It is important that you are as specific as possible.

Name of Lake or Stream _____ County _____ Nearest Town or City _____

21. How many total hours did you fish at this location while on this trip? _____ hours.

22. Approximately (your best estimate) how long did it take you, including rest stops to travel (one way) to this location from you permanent home? _____ hours _____ minutes

23. Approximately (again your best estimate) how many miles is the one-way driving distance from your permanent home to thi location? _____ miles one way (enter 0 if you walked to the site from home).

24. Did you fish at any other location(s) while on this trip?

☐ Yes (if yes, please answer 24a) ☐ No

| 24a. Name of Lake/Stream | County | Nearest Town/City | Hours Fished There |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

25. Which of the following best describes the purpose of this trip?

☐ Fishing was the primary and only purpose of the trip.

☐ Fishing was the primary but not only purpose for the trip. What was the secondary purpose? _____
Would you have made the trip to this location if fishing opportunities were not available nearby? ☐ Yes ☐ No

☐ The trip was primarily for another purpose but I planned to fish when I left home. What was the primary purpose _____ Would you have made the trip to this location if fishing opportunities were not available nearby? ☐ Yes ☐ No

☐ The trip was primarily for another purpose, and even though I fished, I did not plan to do so before I left home. What was the primary purpose? _____

26. What percent (%) of the reason for making this trip could be attributed to fishing _____%.

27. How many other people accompanied you on this trip whether or not they fished? _____
(If you went alone, go to question 28.)

| Relationship | Are they 16 or younger? Yes | No | Did they fish on the trip? Yes | No | Was fishing the primary activit they engaged in on the trip? Yes | No |
|---|---|---|---|---|---|---|
| (Example) Son | ☑ | ☐ | ☑ | ☐ | ☑ | ☐ |
| | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

CONTINUE ➧

28 If it was an overnight trip, what type of lodging did you use?

| Type of Lodging | Number of Nights | Type of Lodging | Number of Nights |
|---|---|---|---|
| ☐ Hotel or motel | _____ | ☐ Rental cottage | |
| ☐ A second home/cottage/ camp that you own | _____ | ☐ Lodge | |
| ☐ Relatives or friend's home or second home | _____ | ☐ Campground | |
| | | ☐ Other, please specify: _____ | |

29 What was the primary species you were fishing for while on this trip?

☐ Yellow Perch
☐ Panfish
☐ Bass
☐ Walleye or Sauger
☐ Pike or Musky
☐ Lake Trout
☐ Steelhead
☐ Rainbow Trout
☐ Brown Trout
☐ Brook Trout
☐ Chinook Salmon
☐ Coho Salmon
☐ Catfish or Bullhead
☐ Suckers or Carp
☐ Smelt
☐ Anything that was biting

30. During what time was the trip taken?

☐ Regularly scheduled time off (e.g., week-ends, after work)
☐ Time off without pay
☐ Vacation time (off with pay)
☐ Other time off with pay (e.g., sick time, personal time)
☐ Other, please specify: _____

31. If you hadn't taken this trip to this location, what would you have likely done instead?

☐ Worked—regular time at main job
☐ Worked—over-time at main job
☐ Worked—a second job
☐ Fished somewhere else
☐ Participated in another recreation activity, please specify: _____
☐ Worked around the house
☐ Other, please specify: _____

32. Which mode of fishing did you use a majority of the time on this trip?

☐ Shore or Wading
☐ Pier or Dock
☐ Private Boat →
☐ Charter Boat
☐ Rented Boat
☐ Ice Fishing

How long was the boat used on this trip? _____ ft.

Was the boat:
☐ Transported to the fishing site
☐ Moored or stored near the fishing site

33. Which fishing method did you use most frequently on this trip?

☐ Casting
☐ Spin or Spin Casting
☐ Bait Fishing
☐ Trolling
☐ Fly Fishing
☐ Spearing
☐ Dipping
☐ Snagging

CONTINUE ➧

34. Next, we would like to know your out-of-pocket expenses for goods and services, including travel, on this entire trip This includes purchases at home made especially for this trip. By out-of-pocket we mean all your expenditures whether you spent money for yourself or others in your party.

No matter what your age, we only want your expenditures Do not ask other people (e g , father) what they spent for you For example, if you paid for the gas and someone else in your travel party paid for the motel room, then record the amount you paid for the gas (and anything else you bought) but not the cost of the motel.

Include all of your trip expenditures whether or not they relate to fishing.

| Category | (1) At Home For This Trip | (2) On The Trip To And From The Area | (3) Near The Fishing Site |
|---|---|---|---|
| Rods, reels, downriggers, bait, fishing line, lures, hooks, weights and other fishing supplies | $ | $ | $ |
| Charter fees | | | |
| Lodging—motels, hotels, resorts, cottage rentals, or camping fees | | | |
| Restaurants | | | |
| Groceries, food & snacks, take-out beverages (including alcohol) | | | |
| Boat gas and oil | | | |
| Auto gas and oil | | | |
| Boat rentals, daily transient slip fees, launching fees | | | |
| Entertainment and other recreation (including bars, night clubs) | | | |
| Other trip expenditures (e.g., parking, shopping) | | | |

The remaining questions on yourself and your family are needed so that we can generalize our findings to all other anglers. Again be assured that the information you provide will remain strictly confidential.

35. What is your race? ☐ White ☐ Black ☐ Native American ☐ Hispanic ☐ Oriental
☐ Other, please specify _____

36. What is the highest level you completed in school?

☐ Grade School ☐ High School Diploma ☐ College Degree (B.S. or B.A.) ☐ Advanced Degree (M.S., Ph.D , M.D., D.O., D.D.S., D.V.M., J.D.)
☐ Some High School ☐ Some College ☐ Some Graduate Medical or Law School

37. What is your present primary occupation? If you are unemployed or retired, tell us your last occupation: _____

38. What is your individual income before taxes?

☐ Under $10,000 ☐ $20,000 to $24,999 ☐ $35,000 to $39,000 ☐ $50,000 or over
☐ $10,000 to $14,999 ☐ $25,000 to $29,999 ☐ $40,000 to $44,999
☐ $15,000 to $19,999 ☐ $30,000 to $34,999 ☐ $45,000 to $49,999

39. If there is more than one wage earner in your household, what is your total family income before taxes?

☐ Under $10,000 ☐ $20,000 to $24,999 ☐ $35,000 to $39,000 ☐ $50,000 or over
☐ $10,000 to $14,999 ☐ $25,000 to $29,999 ☐ $40,000 to $44,999
☐ $15,000 to $19,999 ☐ $30,000 to $34,999 ☐ $45,000 to $49,999